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# RETENTIVENESS IN CHILD AND ADULT<sup>1</sup>

By CEPHAS GUILLET

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I. BIRDS MEMORIZED BY CHILD	

"Here's another book for you from Santa Claus," I said to my two-year-old boy the day after Christmas. "Aw-w-w," he said, and chuckled all the way up stairs. It was a bird book, containing fifty-eight excellent, highly colored pictures of forty-eight different kinds of birds. I showed it to him and he said over all the names after me. He made me go over it all again, and this time he knew three of them, the rooster, blackbird and chickadee. The next day these proved to be the only ones retained. But the third day and nearly every succeeding day he had added new birds to his store, till the twenty-fourth, when he named all correctly. During this time he was actually at work (or rather at play, for we did not allow it to degenerate into lessons) for five and a half hours. This means that on the average each bird required 5.7 minutes, and each name 6.9 minutes to be learned. The canary, parrot, robin and thrush occurred twice in different sizes and positions, and there were two ducks, two grosbeaks, two wrens and three chickadees of different species.

The periods averaged nearly fourteen minutes, being a little

shorter at the beginning and at the end than at the middle of the experiment; at the beginning, because, knowing but few birds, he simply named most of them after me; toward the end, because he had become familiar enough with most of them to say them readily. We urged him very little and generally accepted his "I cawt say't," whether he meant I can't remember it or I can't repeat it. The longest periods were the 9th and 10th which each lasted twenty minutes. The length of time taken, of course, depended somewhat on his willingness, which in turn depended on his physical condition. On the 7th day, for example, at 10.45 A. M., after a run on the meadow, he felt good and showed great interest, saying all the words in about ten minutes; whereas the 9th day at 8.30 A. M., just after breakfast, he got tired and unwilling toward the end, refused to pronounce a half dozen of the last names and was at it twenty minutes. On the 19th day at 6 P. M., after supper, when he felt in particularly good spirits, he did not say "I can't" once and his reactions were generally very prompt. He knew most of the birds well and took but ten minutes to say them. The 24th day he required only six minutes to name all the birds without prompting and the day after he went through the book correctly in five minutes. He was never allowed to see the book except during these periods and we never suggested the birds to him, though naturally he sometimes recalled them to mind and spoke of them.

A week later he was found still to know all except one (red-bird), but required ten minutes to repeat them, showing hesitation in recalling a few, and particularly redbird and yellowbird. Five days later, he still knew all but one, the same one, and said them in seven minutes. It is strange that the name forgotten had been learned on the sixth day and always thereafter said correctly. But he had been learning the colors lately and evidently was applying this imperfect knowledge to some of the birds instead of trusting his memory simply; for he called the redbird as well as the yellowbird "whitebird", while yellow warbler and redstart were recalled readily. Yellowbird was finally recalled but not redbird. He seems to have begun to analyze these two names but not the two former. I was perhaps responsible for this, for on the 21st day, the day after he had first said yellowbird correctly, when he hesitated at this bird, I asked "what color is that?" He replied "whitebird." (Thereafter he always said whitebird for yellowbird before he gave it correctly.) So now when I asked him what color the redbird was, pointing it out, he said first white, then blue, and finally red, but even then would not say redbird. On the last occasion above mentioned he had the same difficulty with the redbird as on the previous occasion, calling it

whitebird again, and he called the redstart simply "start," something he had never done before, though he had always had difficulty with it, not having learned it until the 15th day, and thereafter failing to say it again until the last day. It was indeed the only bird he missed on the day before the last. When asked what color the redbird was, he said red correctly this time, but then when asked what the bird was he said "redstart", though with some uncertainty. When now shown the redstart, he said redstart at once; but I could not get him to name redbird correctly. Three days later he called the redbird "whitebird" but told me the color correctly when asked. Yet when I said "What bird is it?" he replied "I don't know", although he named the redstart correctly at sight. Does this not illustrate the difficulty of trying to teach a child anything formally? Conscious effort would seem to be confusing. I have noticed in general that while the boy now uses the words red and blue correctly, yet when asked "What color is this?" he is quite likely to say blue for red and red for blue, white for black and black for white. The question seems to make him self-conscious, disconcerting him and affecting the correctness of his response. Of course later on when this association has been well established, so simple a question will not confuse him, but will not one more difficult, but relatively to his stage of development equally simple, be just as liable to disconcert?

The following table shows on each day the number of bird-names thus far learned, the number of birds that had been already learned, the new birds added that day, the birds forgotten that day (denoted by minus sign), and the total number of birds named that day:

1st day, three species (no birds previously known)	blackbird, chickadee, rooster	3
2nd day, 3 species, (3 birds previously known)		3
3rd day, 8 species (3 birds previously known),	cuckoo, duck (2) chickadee (2nd), kingfisher, crow, umbrella- bird	10
4th day, 10 species (10 birds previously known),	parrot (2), owl, chickadee (3rd), —duck (2nd)	13
5th day, 15 species (14 birds previously known),	albatross, grosbeak, doves, swallows, flamingoes,—rooster, parrot	17
6th day, 17 species (19 birds previously known),	gros- beak (1st), macaw, redbird, —doves	21
7th day, 20 species (22 birds previously known),	canaries, jackdaw, quail	25
8th day, 22 species (25 birds previously known),	lark, nightingale, —canaries, doves	25
9th day, 25 species (27 birds previously known),	hawk, lovebirds, martin, swallow, —canaries, doves, lark, nightingale	27

10th day, 25 species (31 birds previously known), —canaries, doves, hawk, lark, nightingale	26
11th day, 27 species (31 birds previously known), canary, ibis, pigeon, —canaries, doves, hawk, jackdaw, nightingale	29
12th day, 30 species (34 birds previously known), goldfinch, hummingbird, thrush (2), hawk	37
13th day, 36 species (38 birds previously known), jay, nuthatch, ostrich, robin (1st), vireo, vulture, —doves, hummingbirds, goldfinch	41
14th day, 38 species (44 birds previously known), stork, wren (2nd), —doves, vulture	44
15th day, 40 species (46 birds previously known), redstart, heron, —vulture	47
16th day, 40 species (48 birds previously known), hawk, hummingbirds, redstart, wren (2nd)	44
17th day, 41 species (48 birds previously known), yellow warbler, —doves, hawk, redstart, thrush (2nd), vulture	44
18th day, 42 species (49 birds previously known), cassowary, robin (2nd), —hawk, redstart, yellow warbler	48
19th day, 46 species (51 birds previously known), eagle, wren, magpie, partridge, yellowbird, —hawk, redstart, yellow warbler	52
20th day, 46 species (56 birds previously known), —hawk, redstart, yellow warbler, robin (2nd)	52
21st day, 47 species (56 birds previously known), secretary-bird, —redstart, robin (2nd)	55
22nd day, 48 species (57 birds previously known), stormy petrel, —redstart, yellowbird	56
23rd day, 48 species (58 birds previously known), —redstart	57
24th day, 48 species (58 birds previously known)	58

Between the 17th and 18th days a day intervened upon which no trial was made. He was on a visit to a neighboring city that day and the two preceding, and it was found that the presence of strangers and strange surroundings somewhat excited him and interfered with the naïveté of his behavior. This was plainly mirrored in the fact that on each of these days he named only 44 birds, although the previous day he had named 47 at home and the day after he returned he named 48. There was only one other instance of his losing ground, namely the 10th day, when he named one less than the previous day.

It will be seen that the child added on an average about  $2\frac{1}{2}$  birds per day to his store, and that the number of *new birds* added each day fluctuated between none (3 times) and seven (once). It cannot be said that there was a slowing down of

the speed of acquisition in the latter part of the time. There were 3 apexes of acquisition, namely on the 3rd, 12th, and 19th days (7, 8, and 5 net *additional* birds as compared with the net number recalled on the previous day). After each of these the curve fell with considerable regularity until the next almost abrupt rise. It reached its lowest points, in fact, on the 8th and 10th, the 16th and 17th and the 20th, 22nd, 23rd, 24th. The curve of acquisition of new bird-names was much the same, reaching its highest point, however (6), one day later than the other curve. The acquisition was slow at the end, probably because there were few new birds left to learn and these very difficult (secretary-bird and stormy petrel).

Some names were particularly easy of acquirement, others particularly hard. Of the easy ones rooster was a word already known and the bird was known; the word blackbird had been heard, but had not been associated with a bird; chickadee proved an attractive sound, as it was learned immediately, though never heard before. Cuckoo was very nearly his way of saying cookie (coocoo), so he possessed the word and only needed to get a new association for it, which proved easy; umbrella-bird was easily learned for a similar reason, the oddly-shaped crest of this big bird doubtless helping. Duck, crow, and kingfisher had all been heard and used of the live birds, the last two the previous summer, and the first frequently since then. None of these birds, once learned, ever failed to be recalled, except duck and rooster once, and this last was probably due to willfulness or playfulness, a factor that must be reckoned with in studying children. Other birds that proved easy to learn and recall are owl, parrot, albatross, grosbeak, swallows, flamingoes, macaw, and redbird, all of which are in the first half of the book except the last two.

On the ninth day when he was still unable to recall lark, I substituted the name sparrow because the English lark as pictured looks much like a sparrow, a more useful word for him. He would not pronounce it, however, saying "I cawt". The next day he again refused, but the following day he repeated "payo". Yet the day after, when asked to name it, he recalled its original name, saying "lock". This is an interesting case of the persistence of an association. He failed, however, to recall it the two following days, but never thereafter.

Words particularly hard to learn were redstart, stormy petrel, secretary-bird, magpie, hawk, partridge, yellowbird, eagle, wren (1st), robin (2nd), cassowary, doves and yellow warbler, all of which were in the second half of the book except eagle, hawk, doves and wren. I called the second wren "Jenny Wren" and the first robin "Robin Redbreast", while

the others were named simply wren and robin. The longer name proved considerably easier to learn and remember in both cases. I did not call the second wren, which was our common house wren, "Jenny Wren" until the seventh day. He always kept these two names in their first association, but, though he did this at first in the case of the two robins, he finally applied "Rob Rebest" to both. The fact of the hawk and eagle occurring together on the same page and resembling each other retarded their acquisition. The same was true of the English robin and redstart and the martin and magpie. In the last case the names also are somewhat similar, especially as he called the martin "mockin". When, of a word that he could not recall, the first letter or syllable was sounded, he could usually finish it, but such cases were not counted. We frequently found that a little encouragement was helpful. When he would say "I can't", our "O yes you can, that's a—" would often bring the name. A coaxing request also several times induced successful effort. The "I can'ts" were much more numerous in the second half of the book.

Adding together the number of days each word took to be learned and dividing by the number of birds, I find that the first 29 birds in the book took on an average 7.6 days to learn, and the last 29 birds 12.2 days, or, taking the bird-names only, the first 24 bird-names required an average of 7.8 days, the last of 12.1 days each, showing clearly the effects of fatigue in retarding the acquisition of the associations occurring latest. We always began at the beginning of the book except on one day, the 12th, when we began at the end. On this day the child was remarkably successful, making the largest gain of any day during the experiment. The previous day he could recall 29 names, this day he recalled 37.

He is very fond of seeing me draw cats and mice and frequently says "Mate a kitty, dado". On the ninth day of our experiment he began to ask me to "mate a umbella-bi(r)d", "Mate a tush-bird", "Mate a nightingale singin away", "Mate a gosbeat-a pawt". It is curious that though he had never yet succeeded in recalling the name "thrush" during the regular lessons, yet he here used the word and in an original form (tush bird). He had kept up his interest in this exercise for 23 minutes, when we were interrupted. On six other occasions during the course of the experiment he called for the drawing of certain birds and this no doubt helped to fix some of names in his mind. Those asked for besides the ones above mentioned were in order kingfisher (12th day), chickadee and owl (the day of no trial), vulture, hawk, macaw, nuthatch (18th day), duck (21st), blackbird, ostrich (22nd). All these were learned early and retained well except "hawk". The umbrella bird



and grosbeak were called for on five of the seven occasions, none of the others more than three times. During the week that he was not allowed to see the book, he asked once for me to draw the ibis, eagle, and hawk. I, of course, drew only those that were asked for. One day he commanded "Mate a caw, mate a caw, mate a *me-caw*, a *me-caw*". When I drew the macaw, he said "At's a hawk". So I determined to take a few more lessons from the book before I should be called on again by this critic of two years and three months!

He would sometimes use bird names in his prattle and his sing-song. This I observed six times during the period when he was acquiring them, the names so used being umbrella-bird, flamingo, chickadee, and grosbeak twice, and macaw, warbler, rooster and jenny wren once. He once said "I'm a grosbeak, I'm a macaw, I'm a chickadee," and one night he half awoke from sleep and asked dreamily, "Wha's the hummin-bi(r)ds?" Three days after he had learned all, as he lay in bed after waking, he said over to himself fourteen of the names. The same day, pointing first to me and then to a little friend, he said, "At a pawt and dis a gosbeak." Then putting his hand on my nose, he said, "At's a beak," then he added "a hawk." The next day, turning his back towards me, he said, "Look at my tail." These are rather remarkable applications of his bird-lore. He added on the last occasion, "I'm a jay; I'm two love-birds." There are two love-birds in his book—"kissin togedda," as he expressed it in his original way the day before. We had told him they were kissing each other. Two days later he asked his mother, "What does the redstart say?" His mother passed the question on to me, but, before I could answer, he said, "see me, see me, see me;" I had told him that fully a week before.

The following proved to be difficult where not impossible sounds throughout the experiment: the simple consonants r, v, y, th; the combinations represented by kw, sw, -ing, st, sp, -tsh, j, -dg, -dsh, wh; and many compounds of l and r with other consonants (lb, bl, fl, ld, sl, kl, tr, gr, str, kr, thr, br, rk, rd, rt, rbl). The following were fairly mastered during the experiment: lb, kw, j, x, -dg, -tsh, st, th, -vs, ch. The child prefers to accent the first syllable, as fam'ingoes, me/caw, no doubt by analogy with most English words. The child used b for v, f for sw, d for j, p for sp, t for st, sh for tsh, w for r, f or t or later th for thr, and initial y was omitted.

On Feb. 12th, for nearly half an hour, beginning at 1.45 P. M., I had the child name the birds whose heads I showed him, covering all the rest of the bird, and indeed of the book, with papers in which I had cut holes of different sizes to show the heads. I did not show him two birds consecutively on the

same page but skipped about through the book. He would run away after each and come at my call with great glee thinking it a fine game. After I had tested him on 23 birds, fearing fatigue, I desisted and finished the remaining 32 in the evening in 50 minutes. He named all correctly but 10, namely vulture (called swallow), jackdaw (magpie), thrush (dove), redbird (yellowbird), nightingale (canary), yellow warbler (yellow bird), lark (thrush), swallow (martin), ostrich (partridge), cuckoo. I tested his mother in the same way and she missed the following fifteen: jackdaw (called blackbird and stormy petrel), magpie (blackbird, crow), blackbird (crow), redstart, yellow warbler (thrush), lark (nightingale), dove (cuckoo), swallow 1st and 2nd, chickadee, duck, martin (swallow), cuckoo, partridge (pigeon), chickadee, 2nd. The duck was an English grebe. The child's responses were almost invariably prompt, in fact instantaneous. For the robin he first said "canady-bird," but corrected himself.

On Feb. 14th and 15th I tested his ability to name the birds minus their heads and all surroundings. Of the 58 birds he was able to name correctly all but two, the ostrich and the first grosbeak (called pigeon). The ostrich was called partridge, just as when only the head was shown, but I think that in both cases this was purely a confusion of the names, since he named it correctly next day when a similar trial was made. However, he also named the grosbeak correctly next day. This bird and the pigeon are much the same size and form in the book, but the pigeon is pink while the grosbeak is gray. The head evidently helped him most with the grosbeak, on account of the large red beak, for, when I excluded everything but the beak, he said "grosbeak," after exclaiming, "Any (*i. e.*, no) head on it!" which he sometimes did of birds without heads. It is interesting to note that when I showed him the pigeon without its head the day after he had called the grosbeak pigeon, he called the pigeon grosbeak at first and then pigeon. From this it would appear that form is more noted by this child than color. The other headless birds that were only named correctly at the second guess were redbird (called yellowbird), lark (humming-bird), hawk (grosbeak), vireo (wren), and a flying canary (sparrow). These mistakes also suggest that color is of minor importance to this child at present as a distinguishing mark. While he named the headless jackdaw correctly the first day, yet the next day, when I showed it to him again, he first called it magpie and then jackdaw. Now the magpie and jackdaw resemble each other very closely except in color. Again, the heads of these birds are of exactly the same color (a blue black), yet he only confused them once out of four times, being shown both heads

on two successive days. The jackdaw's head is a little larger and is turned in the opposite direction from the magpie's, which are the only clues he could have, seeing that the bills are alike as well as the shape of the head. The eyes are a little different. I carefully covered the spoon the magpie carried in his bill. That action is of marked interest to this child is shown by his calling the heads of the first robin and the nightingale canary. All these birds are represented as singing with their heads turned up and their beaks open. It would seem as though action played a more important part than color in his perceptions. Similarly the singing lark's head was called thrush, which is also represented as singing; his mother called it nightingale. Again the headless lark was called hummingbird. Here there is no resemblance except in the wings being outspread in flight in both. The color is quite different (mauve and brown). Moreover the headless flying canary was called "sparrow," by which he meant lark. One questions whether children note distinctions of color consciously before their attention is called to them and the names given. We know how many things escape ourselves until we have been trained to observe them, for instance, the many curious and brilliantly-colored mushrooms in the woods. Even as I write, this child, now two years and a half, though he uses correctly black, red, white, yellow and generally blue, yet calls all his light-colored marbles (yellow, light brown, etc.) white, and those of dark color (blue, dark red, purple, etc.) black. The child needs to know the form of things more than their color, and color is given to him through only one sense while form is conveyed to him through not only sight but particularly the very emphatic sense of touch. Color is only one factor in the building up of the perception of form and would seem not to be noted as such and for its own sake at first. His confusion of redbird and yellowbird, both when the head alone of the redbird was shown and when it was shown headless, may be only a confusion of color names. The head of the yellow warbler was called yellowbird, but no other mistake was made with these two birds. The vulture is evidently known by the great size of its body (it is the largest bird but one in the book), for its head was named swallow one day and thrush the next. The second thrush's head, which is not in the attitude of singing, he called first dove with uncertainty and then said "eye," "beak" (pointing to them), then "I don't know." But, being urged to say, he guessed "swallow." These are the only bad mistakes he made. It is not remarkable that he should have called the head of the second swallow martin. The surprising thing is that he should have named the head of the first swallow and of the martin correctly, and that he should not have

confused the heads of the eagle and the hawk (a falcon). In the case of the martin and swallow I think color must have played a part, as I showed him three different swallows' heads, one of which is turned in the same direction as the martin's and is in every respect similar except in color (being brown, while the martin's is a blue-black), and in the martin's head being slightly larger. The head of one of the other swallows is of a different color again, a dark purple with reddish throat, while the martin and the other two swallows have a white throat.

His calling the canary sparrow is a point of much interest for a different reason. When I showed him the headless flying canary, he hesitated a little while and then said "spayo." I said, "No that's not a sparrow, and then he said "canady-bird." He had not heard the word sparrow since the three days upon which I had given him that word for the flying lark, and he had only repeated it once after me, namely on the last of the three days when he said "payo." Now forty-five days after, he recalled this word and applied it to a bird flying like the lark. The sound "sparrow," therefore, had remained reproducible, associated with the visual image of a bird flying (during all this time), and was now for the first time called forth in connection with the visual stimulus of a flying bird. With the head the bird would have been called canary as usual but the headless canary did not at once suggest the name canary, and hence there was a chance for the other association to appear. That he should have called it sparrow rather than lark is possibly due to the fact that "lark" also had through frequent repetition got connected more closely with the visual image of the whole bird.

In order to see how much further the child had carried his unconscious analysis (if I may be allowed the expression), I tested him during the next few days in recognizing the birds when seeing only the bill or, if the bill was not then recognized, extending to and then beyond the eye till the whole head, or more if necessary, was uncovered. I also showed crests alone where present, and, in the case of the owl, the eyes alone. I found that the quail, rooster, and umbrella-bird were recognized by the crest, and the owl by its eyes. The rooster was not known by the bill alone, but the quail was; when shown the umbrella-bird's bill, he said first eagle, then at once umbrella-bird. The following birds were recognized when only the bill was shown: both grosbeaks (one with red, the other with brown bill), flamingo, ibis, macaw, first parrot (large red bill), first canary (not singing), both ducks, pigeon. The following were recognized when a little bit of the head was seen with the bill but not including the eye: first thrush (sing-

ing), first and third chickadees, stormy petrel, lovebird, martin, nuthatch, first swallow, first robin (not singing), goldfinch, dove, yellow warbler, vireo. Not recognizing them at once he would say, "Lill bit more, dado." The following were recognized as soon as the eye appeared: stork, blackbird, albatross, second canary (singing), hawk, second robin (singing), kingfisher, hummingbird, yellowbird, jay, partridge (first said pigeon), eagle, second parrot, second chickadee, crow, second thrush (said "I can't see it, make his eye"), nightingale (said "thrush" for bill only), redstart, secretary-bird. The second "chickadee," a long-tailed tit, has a small black bill much like the martin's but more hooked; before he saw the eye he called it hawk and then martin. He said magpie for jackdaw; but when shown the latter another day, he said magpie when only the bill was shown, but jackdaw as soon as the eye appeared. Of the following the whole head had to be shown before they were recognized: cassowary, heron (fish excluded), lark, magpie (spoon excluded), first wren, ostrich, redbird (but called yellowbird as usual), vulture. A little of the body had to be shown with the head for the recognition of the cuckoo and the second wren; and on two different days the second swallow was called martin until the whole bird was seen. There is evidence of considerable redintegration here, or such an association of the whole with the various parts of which it is composed, that the part, and often a very inconsiderable part, at once suggests the whole, doubtless in a very mechanical and unconscious way. Three birds were known by their crests, one by its eyes, and a dozen by their bills; in thirteen others a small part of the head only needed to be added to the bill; twenty others were known when the eye was added. This leaves eleven birds, eight of which were known when the whole head was seen and two more when the wing-shoulders were added. This leaves only one bird that had to be seen entire to be known, and this bird was confused with one which resembled it closely in every way but in color, in which they differed markedly. Both were flying, though in opposite directions.

While he was learning the birds, attention was scarcely ever called to any part, but he occasionally pointed to and named the tail and eye, and later the beak and legs, as "Look at a eye!" "Little tail stickin' up", "Long beak!" "Look at a big legs!" He would sometimes refer to their actions as "singin' away, he's flyin', sittin' on fence, he's climbin' a pole", the last two original. He noted surrounding objects as the duck's and dove's eggs, the snake in the secretary-bird's bill, and the fishes held by kingfisher and heron.

He was tested with the first twenty birds in the book by

showing him the tail or feet in the same manner that the head had been shown. The following fourteen birds were known from the tail alone: wren and ibis (tip only), rooster and jackdaw (half of tail), albatross, blackbird, chickadee, swallow, dove, cuckoo, both ducks, goldfinch, jay. He knew the flamingo by its feet, the cassowary by its feet and legs, the eagle, hawk, and canary by the feet and tail, the grosbeak by the tail and wing, and the hummingbird by its wing, feet and tail.

I also had him guess the birds from their association with the others on the page. On two pages there was but a single bird, but on each of the other thirteen pages there were on the average about four birds. I tested him on only one bird a day on each page for four days, covering the bird up completely along with its immediate surroundings and leaving the rest of the page uncovered. The only way he could guess the name of the bird was by its association in his mind with the other birds on that page and by its position on the page. During the four days he was tested with fifty-one birds, of which he guessed twenty-six correctly and twenty-five wrong. The exact numbers each day were 6 right and 7 wrong, 6 right and 7 wrong, 8 right and 5 wrong, 6 right and 6 wrong.

## II. BIRDS MEMORIZED BY ADULT

To compare my memory for new oral verbal associations with the child's, I had myself taught similarly the Japanese names for the same birds. Mr. Hikoze Kakise kindly consented to conduct this experiment with me. It came out that I required thirteen days to learn the names, or about half as many as the child. But as my method of learning the names differed from the child's, in that I consciously strove to recall the names and to add as many as possible each time, I took much more time each day than did the child. In fact the total amount of time spent by me in the experiment was 4 hr. 50 min., or only 40 min. less than the child used. It should be mentioned, however, that some time was consumed each day in note-taking. I used an average of 22 min. a day, and one day occupied 40 min. On the 13th day, when I finally succeeded in saying all the names correctly, I required nine minutes to do it; while the child on his successful day required but six minutes. The day after, however ("14th day"), I named the birds in exactly the same time as the child did the day after his first success, namely in five minutes. A week later ("15th day"), I required a little over nine minutes to name all the birds, finding three particularly hard to recall, namely, hikuidori, yamasuzume, and umisuzume. Six days thereafter ("16th day") I required eight minutes to name the birds, finding difficulty only with *oniwatori* and *uzura*. After a further interval of six weeks

("17th day"), however, I was found to have lost nine of the words, two absolutely (hikuidori and kawarahiba), four less completely (akazuru, hibari, hebikuidori, and kasadori), and three I got nearly right (hototogis, uzura, saezuridori). Five others were hard to recall (bakadori, kuro-tsugumi, aka-garas, kasasagi, wase). Moreover, I used thirty-five minutes, or more than four times as much time as six weeks previous. It will be seen that my experience tallied herein very closely with the child's. The child required five minutes more to recall the words after a week's interval, and I a little over four minutes. He did it three minutes better five days later and I a little over one minute better six days later.

It must be taken into consideration that the birds were all familiar to me and so stood out distinct from one another, ready to have a new name attached to them, while they were nearly all quite new to the child. Also my power of articulation is better than the child's. On the other hand, I had no knowledge of Japanese except what every one picks up in his reading, while the child already possessed a large vocabulary of English words, which doubtless had some suggestive value, especially as it comprised some of the words occurring in the bird names; namely, bird, red, black, crow, umbrella, king-fisher, "coocoo", duck, rooster, Jack, love, caw, night, nut. My knowledge of several foreign languages, however, doubtless offset this. Again the child, as we have seen, rather frequently recalled bird names to mind and used them, while only very rarely did any Japanese name recur to my mind and it was never dwelt upon.

In examining Mr. Kakise's notes of my method of recalling, so far as he could gather it, and supplementing his records from my memory, I find that the matter may be resolved into the following kinds of reaction:

- a. The mixing of the name wanted with some other.
- b. The substitution of another name for the one wanted.
- c. Some of the letters and possibly the general character of the word recalled, but generally not visualized; if visualized, in my handwriting.
- d. An impression of the general character of the word,—the number of syllables or the length of the word, the difficulty or lack of familiarity, the heaviness or lightness of sound. Waving the hand to indicate the rhythm sometimes helped me recall a word.
- e. Making a "bluff" at it and succeeding or nearly without any visual or auditory image to guide me, the vocal organs my sole guide; no consciousness till the word is struck.
- f. Method of trial and error: using the vocal organs directed by my ear till, by a process of elimination of what did not

sound right, I finally struck the right word, or what seemed to me right or nearly so. Sometimes I began by a guttural trilling.

g. A feeling of familiarity, an inkling, a foreshadowing, as if the word or sound were approaching and projecting a vague image of itself before it.

h. (1) A feeling that I am nearly right, but not satisfied.  
(2) A certainty that I am wrong.

i. Recalling one of the parts of a compound word.

j. Association with previous knowledge.

1. Of other languages.

2. Of Japanese.

3. Association of character of word with character of animal.

k. Recognition of word when prompted.

l. Ability to finish word begun for me.

m. Recalling the first part or the last part more or less correctly, and then repeating it till it possibly called forth the rest by association.

n. Elimination of the wrong word by being assured it was wrong; and then the line of least resistance to the effort was along the path made by the true word.

o. Uncertainty whether right after pronouncing the word correctly; failure to recognize the word completely after I say it.

p. Mind a perfect blank, incapable even of making a "bluff" at the word.

q. Persistence of an error once made.

The method of trial and error (f) was the most characteristic, and there were several cases of blind attack or "bluff" (e), when I succeeded by the sheer effort of speech without any conscious guidance. There were also many cases of the strange feeling of familiarity without further content or possibility of recalling anything (g), as well as of an impression as it were of the ghost of the word, its general character, without any image, visual, auditory, or motor, of the letters or sounds, but only a vague feeling of the rhythm of the word or some other quality (d). Some use was made of associations as memory hooks (j); on the other hand, there were many cases of interference (a and b).

A slightly wrong pronunciation was sometimes accepted as correct, the error not being detected. Had I been able to see the word or hear it spelled, this could hardly have occurred. I only discovered it when shown the words after the experiment was over.

Beginning with the second day the number of bird-names recalled by me up to and including the day in question, and



the net number of bird-names actually recalled that day were as follows :

2, 7, 11, 14, 22, 26, 34, 41, 43, 45, 47, 48;

2, 7, 11, 14, 22, 25, 32, 40, 41, 42, 46, 48,

It is perhaps worthy of remark how few words were lost once they had been recalled without aid. I made 10 misses, my little boy 47, with the birds. The curve of acquisition both for new names and for net number of additional names each day has three distinct apexes at the 3rd, 6th, and 8-9th days (5, 8 and 8 names respectively), with strong dips at the beginning, and end and between; but there is another for net additional names at the 12th day (4 names). This makes a very regular curve with intervals of 2 days between the apexes.

Fatigue induced by the experiment must have played a very small part in my case, for the first 24 names in order as they occurred in the book required on an average 6.7 days each, the last 24 each 7.1 days to learn or a difference of less than half a day in favor of the first half of the book. In my experiment with the mammals, to be described later, I began on alternate days at the beginning and the end of the book. In this case the first 26 required each on an average 7.2 days and the last 26 required 6.1 days each to memorize.

### III. MAMMALS MEMORIZED BY CHILD

On the 26th of February, in his 30th month, I began to show my little boy a mammal book in the same way that I had shown him his bird book. This was Schubert's *Naturgeschichte der Säugetiere*'. From it I selected 52 animals, all different, of which he was to be given the names, half English and the remainder foreign, equally divided between French and German. I took care that as nearly as possible the words in each language should be of the same length. Of one syllabled words there were 4 English, 3 French and 2 German; of two syllabled words there were 14 English, 6 French and 9 German; of three syllabled words 7 English, 4 French and 2 German; and there was 1 English word of 4 syllables. Thus the 26 English words contained 57 syllables and the 13 French words 27 syllables, and the 13 German words 26 or 110 syllables in all. I also so distributed the names that 12 English, 7 French and 7 German words occurred in the first half of the book and 14 English, 6 French and 6 German in the second half.

Mindful of the influence of fatigue in retarding the learning of the names of the birds in the last half of the book, I began at the beginning and at the end of the mammal book on alternate days. The result showed very clearly how essential this change of

method was to the experiment, and at the same time furnished remarkable evidence of the immense importance to pedagogy of the question of fatigue. During the first seven days, the child learned to name correctly 15 animals, and although they were equally distributed between the first and second halves of the book (8 in the first half and 7 in the last), yet every one was correctly named for the first time in the first half shown him. Again, the total number of correct recollections during the seven days was 38, of which 20 were names of mammals in the first half of the book and 18 of mammals in the second half. Yet the number that occurred in the first half for each day respectively was nearly twice as great as that of the names occurring in the second half for the day, or 24 and 14 respectively. Not only did the child not learn any new words when fatigued but he forgot some he had already learned. For example, the skunk which is the first animal on the list, was named correctly on the 5th day, while on the following day when he began at the end of the list, he could not recall it clearly, saying "hunks" instead of skunk. This word "hunks", whose inception was evidently due to fatigue, persisted through nearly the whole of the experiment, although corrected each day. Sealion and narwhale which occur in the second half of the book and were named correctly for the first time on the 6th day, when we began at the end of the book, could not be recalled on the next or 7th day, when they occurred in the second half as taken up on that day. To attempt therefore to teach a child anything when fatigued is not only futile as regards new acquirement but is even destructive of progress already attained. Moreover the effects of fatigue are subtle and not always easily or readily discernible in the behavior or appearance of the child. It was not until the 7th day that I noticed signs of fatigue in the child towards the close of the experiment, namely holding his head with his hands, and tripping and falling as he ran away. However, I divided the words into two equal sections and gave him them thereafter at different times of the day, while still continuing the alternation in order. The result was a marked change. The number of words repeated in the first half of the experiment and the second half was about the same, even a few more in the second (255 and 262). The number of new words that came in in the second half for each day was twice as great as in the first half (25 to 12). Two periods in the day, therefore, of 10 minutes each proved not to be too much for the child. Let us hope that the suffering that this child, healthy as he is, must have undergone through fatigue in the earlier part of the experiment will prove to have been vicarious, and by its suggestive

value help to lift the burden that weighs so heavily upon childhood throughout our land in school and shop and factory.

The child required 21 days to learn the mammals, less by 3 days than he took to learn the birds. But as the time spent each day was longer, being on an average 19 minutes, and about six hours in all, there was about an hour more time given to the mammals. It should be remembered that there were four more *names* of mammals than of birds, but six fewer mammals. At times his attention was very flitting. Once he ran to his mother after each animal to tell her the name. On that and one other day he consumed 30 minutes which was the longest time spent over the book on any one day. The shortest time was 12 minutes and occurred four times, the 2nd, 5th, 19th and 21st days. It should also be mentioned that this experiment was only conducted during five days of the week, Saturdays and Sundays being omitted, except the 21st day which was a Saturday. The experiment thus lasted 4 weeks. Each mammal required on an average 7.6 minutes to be learned, as compared with 6.5 for the birds. It should be remembered that half the mammal-names were foreign, and hence, as will be seen, harder to learn.

It seemed to us throughout that he took less interest in the mammals than in the birds. This might be accounted for by the brilliant colors of the birds and especially their greater naturalness and activity. The mammals are represented in quite wooden postures. In books prepared for children it would be better to have a few good illustrations, representing the animals at work and play, than a great number of reproductions of museum specimens. My boy was constantly on the lookout for activity, and in its almost total absence, he would try to supply it, making use of every hint. For example, many of the pictures in the mammal book contained representations of water; so the child would frequently say "He's drinkin'", though no animal was represented as in the act of drinking. "He's goin' to catch it", he said, seeing a duck in the water with mammals on the shore, but no mammal was represented as trying to catch anything. Also he said that the raccoon was going to jump on the bear though the illustrator was innocent of any such intention. Perfect decorum was observed by all the animals, who evidently had sat for their pictures. He was particularly interested in the tails and eyes of the mammals and in their open mouths. "He goin' to bite me," (putting his hand on the open jaws) "he's got some eye" (hedgehog), "where his eye? there 't is" (porcupine) "there's his eye" (whale), "he has some tail" "look at a horns." He noticed the mole had no eye visible "any eye!" (no eye). The keenest observation, perhaps, was

his remark on seeing the forlorn looking donkey: "he's cwyin'".

The foreign words were introduced in order to test the child's relative ability to learn foreign and English words. The child's playful prattle contains an exceeding variety of sounds, many of which are thought to be lost through the growing specialization imposed by the necessity of learning and using exclusively a single definite set of sounds, known as English or French, etc. It seemed to me of interest to discover how far such specialization had already proceeded in a child so young.

The following table shows for each day the number of mammals so far learned, the new ones added that day, those forgotten that day, and the total number named that day. Those forgotten are preceded by a minus sign.

2nd day, 1 mammal, camel	1
3d day, 3 mammals, spitzmaus, anteater	3
4th day, 4 mammals, goat	4
5th day, 7 mammals, skunk, zobel, porcupine	7
6th day, 12 mammals, lama, gazelle, giraffe, sea-lion, narwhale, —skunk	11
7th day, 15 mammals, wiesel, jackal, schnabeltier, —skunk sea-lion, narwhale	12
8th day, 18 mammals, ours, dachs, zébu, —skunk, zobel	16
9th day, 26 mammals, hedgehog, guinea-pig, armadillo, wild boar, tapir, chamois, seal, wal, —skunk	25
10th day, 32 mammals, maulwurf, opossum, kangaroo, muskrat, biber, taureau, —skunk	31
11th day, 33 mammals, chevrotain, —skunk, guinea pig, kangaroo, wild boar, taureau, narwhale	27
12th day, 37 mammals, manis, rhinoceros, zebra, morse, —skunk, wild boar, chevrotain, taureau	33
13th day, 38 mammals, ferret, —skunk, rhinoceros, wild boar, chevrotain, zebra, morse	32
14th day, 39 mammals, musk-ox, —skunk, rhinoceros, zebra, sea-lion	35
15th day, 43 mammals, flusspferdt, esel, seebär, manatee, —skunk, musk-ox, zebra	40
16th day, 44 mammals, dauphin, —skunk, flusspferdt, chevrotain, esel	40
17 day, 46 mammals, loutre, moose, —skunk, flusspferdt, esel, seebär	42
18th day, 48 mammals, raton, renntier, —moose	47
19th day, 49 mammals, edelhirsch	49
20th day, 52 mammals, renard, volverenne, paresseux, —edelhirsch	51
21st day, 52 mammals	52

The aggregate number of days the child said correctly the 26 English words was 318, the 13 French words 94 days, and the 13 German words 138 days. French words are, therefore, if we can draw any inference from this test, nearly twice as hard as English, and German words not one quarter harder than English; or to be more exact, French is 59.1 per cent. as easy as English, and German 83 per cent. as easy. Thus German is 23.9 per cent. easier for this child than French. As he is partly of French descent and not at all of German, it would appear that heredity must play but a small part in the acquirement of language, and the onus of proof rests with those who hold that it has any direct influence. To a child whose mother tongue is English, it is not surprising that German, a Teutonic language like our own, should have proved easier than French, as that language much resembles our own in its pronunciation and particularly in its accentuation. The German way of pronouncing *sp* was no harder for this child than the English and the *z* and *sch* proved easy; the *pf*, however, he never mastered. *Flusspferdt* and *Edelhirsch* proved very difficult, and *Maulwurf* rather difficult. On the 8th day, by watching my lips, he was able to pronounce *Wiesel* without substituting a *b* for the *w*, but he did not pronounce it correctly of his own motion till the last two days. He had the same difficulty with *Wal* and *volvenne*. One of his chief sources of trouble with French, besides the accentuation or lack of strong stress, was the frequent occurrence of the letter *r*. It happened that every French word but three contained this letter. The French words in order of ease beginning with the easiest were *ours*, *zébu*, *chamois*, *armadillo*, *taureau*, *morse*, *dauphin*, *loutre*, *raton*, *renard*, *volvenne*, and *chevrotain*. The last two he never pronounced correctly. I had to be satisfied with *chemotain* and *volvenne* at the best. *Volvenne* was *bolwenne* and *bolvenne* until the 20th day when he recalled it for the first time and called it *volvenne*. For  *paresseux* he said *cacasseux* on the ninth day, and thereafter when he recalled this word he always so called it until the last day when he corrected himself and added "paresseux." His pronunciation of the so-called nasals is interesting. These sounds evidently puzzled him. At first he said *daupha* and *wato*; but he seemed to feel there was something lacking in his pronunciation and to supply the lack he added the syllable *nna* and said *dauphanna* and *dauphinna* (8th day to 20th) and *ratonna* (13th day to 18th inclusive) and sometimes *temotan* and *chemotanna*. It is remarkable that he should have supplied an *n*, as I did not suggest such a letter except in so far as a proper pronunciation of the nasal *in* and *on* would do so. He had no difficulty with any other vowels, however, in either language, even the

French *u*. For chamois he persisted in saying "chambwa," like wha in wharf. This was perhaps his way of mimicking the foreign accent. English words that proved hard to pronounce were ferret, kangaroo, giraffe, porcupine, zebra, and especially rhinoceros, which he never could say better than wynoceos and frequently the *n* was left out as well as the *r*'s. Porcupine was always portupine, giraffe dewaff. Altogether I am inclined to think that those who speak of the infinite variety of the child's instinctive speech in the babbling stage are possibly correct as regards vowels but probably mistaken as regards consonants. In any case it seems as though if one wished to take advantage of the "nascent period" for speech in the acquirement of a foreign language, one would have to begin it at birth, where many other nascent periods lie. The first sound my own child made (namely, in crying) was kaz-thá, the second consonant lying somewhere between a *z* and a *th*, in fact just like the Japanese *z* in *azaras* to my ear.

The curve of acquisition of the names of the mammals is of the same general character as that for the birds. The highest point was reached in the second experiment three days earlier, namely on the 9th and 10th days, and was slightly higher, the greatest rise in the net number of mammals on any one day being nine, and the greatest number of new names added being eight, both on the 9th day. There were 3 other marked apexes, namely on the 6th, 12th, and 15th, and, for number of birds only, also 18th day. This makes a strikingly regular curve, the apexes being all 3 days apart with a strongly marked dip between. In fact it is precisely similar to my curve for the birds. After an interval of a week he took the same amount of time to name the mammals, namely 12 minutes. He still remembered all except *Edelhirsch*, the last learned, and skunk had degenerated again into hunks. He also mispronounced zebra (deba), *volverenne* (bolbenne), and *dauphin* (dauphinna), and said hockena at first for hedgehog and cacasseux at first for  *paresseux*, though in both instances he corrected himself.

In the learning of English words the length of the word had little if any influence upon the time required; for the one-syllabled, two-syllabled, and three and four-syllabled words respectively, required on an average 8.7, 8.6, and 8.7 days to learn. Indeed if one omits the one four-syllabled word rhinoceros, which was especially difficult, the average for the three-syllabled words is 8.3, showing a slight improvement upon the shorter words. It was different, however, with the foreign words. Here the corresponding figures were for French words 12.3, 13.5, and 15 days, and for the German 8.5, 10.9, and 13 days. The longer the foreign word, therefore, the harder it was for this child to master.

From time to time the child would make allusions to the animals in his play. The second day he said to me, "Djou portupine" and called his mama a biesel the 8th day. Three days later he said, "I'm a biber, I'm a muskrat, mama." These occur on the same page. Also, placing his fingers together at the tips, he said, "At's a schnabeltier." On the 16th day, building blocks he said, "cacasseux, at's a gazelle"; the next day, pointing to his boot which he was lacing, he said, "At's a renntier", and of two pencils he had placed in a line, "At's a narwhale, dauphinna, I eat it." Two days later one of his blocks was "a ours"; two days thereafter his boot "a jackal", also his mother (You's a jackal). He used the word opossum the next day and zébu two days later. Some days later he said, "The alleguatehs will eat my schnabeltier all up," and indeed the live alligators threatened to eat the whole dead animal book up in interest. I had taken him to see the alligators at the University. He was frightened by their hissing and kept a considerable distance away; but being alarmed for my safety as I stood quite near them, he came and pushed me away determinedly, saying, "They scare you; those alligatehs are naughty." This was rather brave for a frightened child. When he got safely down stairs he told a professor, "Those alligators are afraid of me!" Thereafter, the alligators were much more real, much more a part of his psychic life, than all the pictured mammals. For example, of his blocks he said, "Look out! You're stepping on my little alleguatehs." And when he sees me getting ready to go out, he says, "Where you goin'? To see the alliguateths?" or, "to see the 'coons?" (live 'coons at the University) whereas the "raton" is little more than a word. He also shows increased interest in the parrot now that he has seen a pair at the University, and wants me to draw a parrot more than formerly.

On the 11th day of the experiment, while I was drawing cats and mice, he said "Make a biber, a muskrat, a zobel." On the 13th day he drew two loops with a tail at one end and a dot for an eye at the other and called them "Spitzmaus." The tail was made with the same stroke as the loop and was from a half to three quarters of an inch long; the loops were about 2 inches by a half and two inches and a half by one and a half. This is rather early for any definite form to appear in a child's drawings. He had made several drawings before this, the first being an "owl" when he was 2 years 4 months 18 days old. This also was an oblong, about 4 inches long, considerably wider at the head end where he placed three dots as eyes; there was a tail at the other end. It has been said that the child in its drawings is first and chiefly interested in the human form. This was not the case with my boy. He did make a man after making the

owl, but he has never made one since, though he has made many mice and cats. This is no doubt due to the fact that I have constantly drawn for him cats and mice and birds, especially owls and parrots, and scarcely a single human figure. His man, above mentioned, was rather more complicated than his owl, and the eyes instead of being dots were two round scribbles, imitating no doubt the big owl's eyes I made for him. At one end he drew a narrow oblong continuation and called it a "poke." Then he drew a third figure on the same page, big and round, with a tail at one end and three dots for eyes at the other, and called it a "bin." These words are probably original. His mice and cats are all simply loops or oblong figures with a tail at one end and eyes one, two, or three, at the other. Once when he showed me a "little mouse" with an eye but no tail, I said, "where's his tail?" "Right here", he replied, drawing a line from one end of the figure as a tail. As I write this part of the article, the child is two years and a half old.

While being tested from day to day the child made much less effort to recall than I; as a rule his responses were pretty immediate, and when he did think hard, he generally thought silently. Hence he did not give occasion for so many observations of his method. But, from the very immobility of his vocal organs, so far as I could see them, I should judge that he was chiefly working in the auditory realm, striving to hear the sound that had come to him with the visual image. In such a case he sometimes looked at the animal and at other times straight before him. Of course the words were frequently imperfect when first recalled and several times only one part of a compound word was given; as kingfish (kingfisher), queel (quail), ogle (eagle), wobble (yellow wabblers), tart (redstart), tomy or petel (stormy petrel), chem (*chevrotain*), and hilsch (*Edelhirsch*). Of the mammals I counted no incorrect pronunciations as correct unless I felt it was the best the child could do with his present powers of articulation. There was very little mixing of names, as mawkten for martin (confused with magpie on the same page) and lockin for lark confused with mockin his usual word for martin; but there were many cases of substitution with the birds, though very few with the mammals; examples are swallows for doves, lark (and another time "lock, lockin") for redstart; stork, macaw, eagle, grosbeak and parrot for hawk at various times, macaw for manatee, "wild" (boar) and do-bär for See-bär. With the child this was probably oftener a confusion of the animal than of the name, with me it was a confusion of the name. I noticed very few instances of his audibly correcting himself. One was "fish, fush", and later "fush, thush" said two suc-



cessive days, another "lockin, no seh, mama, lark"; in two other cases he got the last part of the word first and it suggested the whole word, namely, "finch, goldfinch" and "bu, zébi." Very often the first syllable or the first letter or even the placing of my vocal organs in position to begin the word was sufficient to suggest it to him; as for example, h-hawk, hum-humming birds, ma and the next day m-magpie, r-raton, r-renard, v-volvenne, n-narwhale, chev-chevotain, e-Edelhirsch. Examples of the persistence of a wrong association are "lockin" and "moss" frequently for lark and moose, and the naming of the yellowbird "white-bird" always before saying yellowbird, once he had made this mistake. By analogy with yellowbird and umbrella-bird, he would sometimes say canady bird and heron bird, and tickabirdie (chickadee). He called the secretary bird snake-bird from the snake in its bill before he could name it by its proper name; and he called his birdbook parrotbook from the large and gaudy picture of a green parrot on the cover; while of his mammal book he once said "I want to see the book daddy-lion and mama-lion" from the picture of the two lions' heads on the cover which he had been told were the daddy lion and mama lion.

#### IV. MAMMALS MEMORIZED BY ADULT

With Mr. Kakise's aid I learned the Japanese names for the 52 mammals in the same way I had learned the 48 Japanese bird-names. The birds had required 12 days to be memorized, the mammals required 13 days, or an exactly proportionate time. I did not allow myself to be granted so much time to strive to recall the names as in the previous experiment, using an average of only 19 minutes per day instead of 22, or 4 hours 26 minutes in all. It would, therefore, appear that there is nothing to be gained by an excessive expenditure of time and effort in recalling. I missed only two words on the 12th day and also on the 13th. On the 14th day I said all correctly in 4.5 minutes, and did the same the next day. It is rather odd that in repeating the names of mammals, the child and I took on an average the same amount of time per day, namely 19 minutes. But he required 20 days to learn them to my 13. His maximum time per day was 30 minutes, mine 22; his minimum 12 minutes, mine 4.5. A week later I still remembered all except that I confused the words for sea-lion and manatee (Kai-hyo and Kai-giu). The child after an interval of a week missed only *Edelhirsch*, which, however, he pronounced correctly when prompted. He mispronounced several, however, saying *hunks* (skunk), *portupine*, *dewaff*, *bolbenne*, *deba* (zebra), *dauphinna*, *cacasseux* at first for *pareseux* and then, when I said "no," corrected himself, and in the same way first called

hedgehog *hockena*, no doubt being influenced by the French words ending in a nasal. I required six minutes, and the child twice as long. Then, after an interval of six more weeks, we both tried again. I had forgotten 15 and required an hour for the effort. The child had forgotten 35, but he used only 25 minutes in trying to recall the names, not being desirous or capable of making so much effort as I.

Beginning with the second day, the number of mammal-names recalled by me up to and including each several day, and the number of mammal-names actually recalled that day were as follows:

1, 2, 5, 11, 16, 28, 34, 39, 44, 46, 51, 52, 52

1, 2, 5, 11, 14, 28, 31, 37, 43, 43, 50, 50, 52

In 14 cases I missed words previously known; my child missed 41 times. This does not greatly differ from our record with the birds. My curve of acquisition rises and falls with much the same regularity as before, except that the intervals are one day instead of two, the apexes being on the 5th, 7th, 9th, 10th and 12th days.

There is a remarkable rise on the 7th day of 12 new names and 14 net additional names. That day was a Tuesday and the rise was apparently due to the fact that I omitted Saturday and Sunday repetitions during the course of this experiment, but not of the former one. Through not repeating the words on Saturday and Sunday, my score was little increased on Monday but more than proportionally increased on Tuesday. On the following Tuesday there is another sharp rise of 5 new and 7 net additional names. In the number of names recalled there was a greater rise on these two Tuesdays than on any other day; while on one of the Tuesdays (the second) was only one word missed that had been previously learned, and on the other Tuesday none. On Monday I had to expend much energy in recalling words that the two days' rest had partly obliterated or sunk deeper below consciousness. On Tuesday I got the full benefit of the general Sunday rest in the ability to turn my energy to the acquirement of new words without the embarrassment of having to hold on to half-learned words. The relative loss of Monday is more than made up on Tuesday. It is possible that the long interval had contributed to the fixing of the words in the mind, though not in a way to be readily recalled at first.

A careful examination of these notes shows that my method of recalling these words varied little from that used with the others. Association (j) was more used this time, however, and was of great help. The first and third words recalled were recalled by its means, and altogether this method, without any systematic effort to exploit it, proved possible and helpful in 17

cases, or one-third the number of words. The mind naturally seizes any suggestion of this kind, however remote. In ten cases the association was with English, French or German words, in four cases with Japanese words; in three other cases a connection was seen or imagined between the sound of the word and the appearance of the animal. In only three cases were words so memorized forgotten, and then only partly forgotten. The method of trial and error (f) is the usual one when the word does not at once recur or when I have no association in mind by means of which to recall it. The word is usually built up gradually from day to day, beginning often with a mere feeling that it is *there*, or a curious sense of the character of the word. And just as the word becomes more and more clearly conscious, so it gradually fades out of consciousness, until but a syllable or a letter (not necessarily the first or the last), or an indistinct perception of its vowel sounds or its length, or its rhythm, or even only a vague feeling of familiarity remains. In only three cases was the word completely lost after an interval of six weeks.

Such an experience makes one rather incredulous of Dr. Titchener's somewhat clear cut division of consciousness into two states. If, applying his theory to the memory of a word, he calls the clear consciousness of the whole word one state, and all states of consciousness below this another, he will, of course, count two. But these other states are indefinitely many and diverse, from a vague feeling of familiarity, the ghost of the word that may or may not take on flesh, to the feeling that the word is not quite right, though only one letter or sound is astray.

#### V. THIRD LIST OF ANIMAL-NAMES MEMORIZED BY ADULT WITH ADDITION OF VISUAL WORD-SIGN

To see what difference the addition of the visual image of the word would make, a third list of 52 animals was selected, and the animals were shown me day after day, including Sunday, by Mr. Kakise, while he both repeated to me and showed me their Japanese names. Six of the words proved to be ill-chosen, as being too much like words I had already learned, and were rejected and others substituted for them the fourth day (one) and the seventh day (five). Leaving these six out of account, the other 46 names were mastered in 10 days, or in three days less time than the 48 bird-names and in four days less time than the 52 mammal-names. The additional six names, though introduced so late, were all recalled with the rest on the 11th day, except one, and this long word (*noko-girizame*) was finally recalled with the rest on the 13th day, which was the 7th from its introduction. It may be fairly in-

ferred, therefore, that the addition of the visual image of the word will hasten by three days my memorization of about 50 Japanese names of animals. The total amount of time given to this third series of words, however, was greater than that given to the others, as the average time each day was longer, being 26.6 minutes per day for the ten days and 24.5 per day for the 13 days. The maximum time per day was 33 and the minimum (12th and 13th days) 14 minutes. The six words introduced late got, of course, less time than the others, and, what is of far greater importance, fewer repetitions.

Beginning with the second day (Wednesday), the number of names recalled up to and including each several day, and the number of names actually recalled each day were respectively:

1, 5, 9, 15, 22, 30, 40, 44, 46.

1, 5, 8, 14, 22, 29, 40, 43, 46.

It will be seen that names once recalled were dropped but four times during the experiment, a much better record than when no visual image of the word was allowed. A curve plotted from these figures shows an almost steady rise to the 8th day, in this differing from the previous curves. A certain periodicity is shown as before by the apexes at the 3rd, 6th, and 8th days, but the first two are not succeeded by so marked falls as in the former experiments.

After an interval of six weeks I found I could only recall 14 of the 52 names, though I tried for an hour. Among the 14 was only one of the six names that had been introduced late. This leaves 13 words recalled out of the 46, or 33 forgotten. This is a worse record than the child's, for the list of mammal-names, half English and half foreign. And it is two and a half times as bad as my own record with the list of mammals learned without the visual image of the word. This is probably sufficiently accounted for by the fact that in being memorized the second list of names was repeated on 15 days, while the third was only gone over on 13 days, and still more by the fact that I was tested on the second list after a week's interval, but not on the third list. The child also was tested on his list after a week's interval. But even when due weight is given to these considerations, it would appear that the addition of the visual image, while it makes the foreign word easier to learn, makes little difference to its retention, partly because one makes one's own visual image of the word in time, if not given one and the lack of the visual image makes for a deeper motor and auditory impression. It may also be inferred from this study that a given amount of time accorded to the learning of language will produce better results if distributed over many days than if lavished on a few. In the 16 repetitions of

the second list (the 16th being after a week's interval), I occupied 4 hours 36.5 minutes; in the 13 successive repetitions of the third list I occupied 5 hours 18 minutes with the additional advantage of the visual image; and yet the former list was very much better retained. And the slight expenditure of time (six minutes) devoted to the repetition of the list, with effort to recall, after the interval of a week, which made the 16th repetition of the second list, undoubtedly had much to do with my comparative success in recalling these words after an additional interval of six weeks. All this suggests to the educationist the great value of periodic repetition and reviewing.

I next set about ascertaining how many repetitions I should require in order to relearn the words so badly retained. I accordingly had myself prompted in those I did not know and tried the list again the following day, when I succeeded in half an hour in recalling 44 out of the 52, again recalling only one of the extra six words. The next day I recalled 49 in 11 minutes, two of those missed being still of the aforesaid six. The following day all were recalled in 7 minutes. Three repetitions, therefore, proved necessary for the retaining of the words. But a week later five were again missed, one of them belonging to the extra six.

I put my little boy through the same process with his English and foreign mammal-names. After the six weeks' interval he remembered 17 of the 52 words. Half of the others he could give me when I uttered the first letter or syllable. The 17 words recalled were *Wiesel*, fegwet (ferret), *Sobel*, kangaroo, guinea-pig, opossum, *Dachs*, muskrat, *taureau*, *zèbu*, tapir, wild boar, camels, dervish, gazelle, goats, seals. He said aw for Wal, loute (*loutre*) for *ours* and gazelle for *Esel*. In relearning the words he, like myself, made very great progress the first day and then rapidly slowed down. He required three times as many repetitions as I to relearn 52 words. Sometimes he said them all at one sitting, at other times he took but a part of them at one period. I let this depend on his own willingness. The numbers recalled at each repetition and the time required were as follows:

		English	German	French	Names
1.	One period; 25 minutes:	12	3	2	=17
2.	Two periods; 28 "	18	8	6	=32
3.	Three " 25 "	23	9	8	=40
4.	Two " 20 "	24	12	8	=44
5.	Two " 25 "	24	10	9	=43
6.	One " 10 "	26	11	9	=46
7.	One " 12 "	26	10	10	=46
8.	One " 12 "	26	13	10	=49
9.	One " 12 "	26	12	12	=50
10.	One " 15 "	26	13	13	=52

Those missed at the 8th repetition were *renard*, *urs* and *volverenne*, at the 9th *raton* and *Edelhirsch*; on the last day he hesitated a long time at *Renntier* and *Edelhirsch*, first saying *renard* for the former. Instead of the 21 repetitions, therefore, which had been necessary to learn the 52 words in the first place, he now required 9, while I had required 3 repetitions instead of the original 9 to learn 46 words. It is evident that the French words were still harder than the German, and the German words much harder than the English. All the English words were known on the 6th day.

Some of the more interesting examples of the play of memory are *missmaus-krismaus-spitzmaus*, also *spitzmousies*, *phinphin-dauphin*, also *phana* for *dauphin*, *muskox-muskrabbit-muskrat*, *stunk* for *skunk*, *ants* for *ours*, *dit*, *hed*, *ketchog*, and *hedgekog* for *hedgehog*, *bolepol* for *volverenne*, *caresseux* and *carresseute* for *pareseux*, *mayma* and *ibis* for *manis*, *fanton* for *raton*, and *wynocewofewos* for *rhinoceros*. The child gave evidence of the use of methods a, b, c, d, f, i, l, n, q as detailed on pages 331 f.

Some of his remarks during this experiment were: he's *cwawlin* along, I guess (of the duckbill); he's *goin* to lie down, I guess (of the porcupine); look at the black feet (of the muskox); they *fightin* togeddeh, aren't they? (of the reindeer and stag standing quietly facing each other). He likes the monkeys far better than any other animals in the book, and frequently asks to see them. He is doubtless attracted by their grotesque resemblance to human beings. At the page containing anthropoid apes I asked him "What do the monkeys look like?" and he replied at once, "They look Jack, I guess." Being asked which looked like Jack, he pointed to the chimpanzee.

I now tried to get him to learn the English words for the animals whose French and German names he had learned, but it was in vain. I tried for a week and decided it was no use to try longer. The first day it amused him and he pronounced the words after me well and easily; but throughout the week it was impossible to get him to say the English words of his own motion. He would insist on the foreign word and would always say when I prompted him, "No, not *dolphin*, *dauphin*, not *sable*, *Zobel*, not *otter*, *loute*," etc. The only exception was *beaver*, which he would sometimes say for *Biber*. He even retained the *v* sound in *Wiesel* and *Wal*, and the French pronunciation of *zébu*. Two weeks later I showed him the book again and we went through it. He was particularly interested in the red squirrel through having seen several (gray) lately in a park. Again he substituted no English word for the foreign except *beaver*. He had seemingly forgotten six of the

words again, namely, *loutre*, *renard*, hedgehog, *volverenne*, *raton* and *Edelhirsch*, and said *caresseux* for  *paresseux* and veva for zebra. He was then, at the close of the whole experiment (15th June), in his thirty-third month, a healthy, active, naïve boy of possibly more than average alertness, intelligence, and energy of will.

Toward the end of May the boy was taken twice to the Agassiz Museum and once to Barnum and Bailey's menagerie. The first day at the museum he named correctly the following animals: kingfisher, owl, fish, monkey, *renard*, *Dachs*, 'coon, *dauphin*, cats, goats. It is interesting that the real raccoon which he had seen before alive as "coon" and far more frequently pictured as "*raton*", was now called 'coon. (In this connection it might be mentioned here that several days later when we came to the raccoon in the animal book and I called it so, he said "Did you see some the University?" and added "Where are de alligatehs?") The following were named incorrectly, the name he gave being in brackets: another raccoon (opossum, rabbit), caracal and lynx and leopard (tiger), seal (muskrat), roebuck and chamois (narwhale and giraffe), a seal with head raised high (sea-lion). Two birds which were quite unknown to him, the curasoa and turnstone, he called respectively stork and dove. I did not correct him in any instance and the next day he was taken again. This time he named correctly monkeys, bats, deer, narwhale, *dauphin*, owls, ibis, rabbits, giraffe, moose, guinea-pigs, tiger, kingfisher, crow, blackbird, camels. For the following he said the names in brackets: beaver (muskrat), leopard (tiger), gazelle (goat), opossum ('coon), zebra (horsie, tiger), sloth (monkey), flamingo (ibis). Again he was not corrected and the same day after lunch and his usual midday sleep I took him to the menagerie. There he named correctly camels, giraffe, elephant, monkeys, lion, deer, goats, zebra (first called *Esel* which occurs on same page as zebra in his book. The leopard was called tiger and the rhinoceros *Flusspferdt*. The following, of which he knew the pictures, were not named: tiger, kangaroo, tapir, lama, bear, wild boar, zebu. I think he knew the tiger, but would not name it. Three days before, seeing a big gray domestic cat, strikingly barred on legs, head and tail, he had remarked spontaneously first "he's gray", and then "he's a tiger." The great number of animals rather bewildered him and he took little interest in naming them, and indeed a less demonstrative interest of any kind than I had expected. But animals in cages are little better than stuffed animals in a museum, of which he had seen a great number the same day and the day before.

My method in my third experiment in the learning of Japan-

ese names of animals differed from that used in the others by my greater use of visualization. The relative infrequency of methods *e*, *f* and *m*, compared with the former experiments, shows that I trusted less than before to the memory of the vocal organs and more to the visual image. This may be one reason for my failure long to retain the memories: the motor memory is probably more tenacious than the others. On the other hand I found myself using and profiting by the visual word image less than I had expected I should. My mind seems to have got into auditory and motor channels for this purpose more than is usual with me. Is it not possible that a man's visual or auditory or motor-mindedness may be a result of habit, environment and training more than of a native condition of the mind? Visualization of the word did occur, but I felt it was a much less prominent factor than it would have been had I used it also in my earlier experiments.

The decreased reliance upon the vocal organs to retain words probably accounts in part for the numerous cases of complete disappearance of a word. There were 16 such cases as compared with but two in the former experiment. A visual image if retained at all would be more likely to be complete than a motor impression, as the former is one act of the eye and taken in by one effort, all parts being equally clear, whereas the motor image is a series, if the word is of more than one syllable or even letter. One sound, on account of emphasis or some peculiarity that made it of especial interest, would be likely to make a deeper impression upon the vocal organs than the others, as, for example, the sound *k* in *kairi*, which alone was retained in the former experiment, *n* in *kamonohas*, *a* in *roba*, *aras* in *yamaras*, *zangko* in *zenzangko*, its repetition then drawing out the rest of the word, etc. Of the words *lost* 87% (13 out of 15) left some conscious trace behind in the auditory-motor experiment, and but 58% (22 out of 38) in the experiment in which the visual image of the word was added. On the other hand the visual image seems to make for clearness, though not for permanence, of impression, for in repeating the series learned without the visual image I six times failed to recognize words after I had said them correctly; while in the series with the visual image of the word this happened only once.

Association was used rather more in the third experiment than in the second, namely, in some 24 words as compared with 17. Eight of the 15 words retained six weeks had been learned at least partly by its aid; in the former experiment this was true of 14 out of the 37 retained. Six of the associated words were completely lost in the last experiment, none in the previous one. Sometimes the association alone was recalled, not bringing with it the desired word.



It might be supposed that the retention of a word would depend upon its length; and, indeed, I found that a word's length not only materially affected the facility with which the word was learned, but also had considerable effect upon ease of retention, when it had not been learned with the aid of the eye. The number of Japanese words of the several lengths in the three experiments and the average number of repetitions required to learn them are as follows:

5	one-syllabled	words	required	3.4	repetitions
45	two-	"	"	4.7	"
32	three-	"	"	6.2	"
40	four-	"	"	6.6	"
24	five-	"	"	6.9	"
5	six-	"	"	6.2	"
1	seven-	"	word	9	"

The longer the foreign word, therefore, the more difficult it is to memorize. This also was the child's experience.

The 48 words of the first series contained 170 syllables.

The 52 words of the second series contained 154 syllables.

The 46 words of the third series contained 154 syllables.

The 6 extra words of the third series contained 26 syllables.

There were more long words in the third series than in the second; yet the third series was mastered more quickly, another evidence that the addition of the visual image makes for the rapid memorization of foreign nouns. The 14 words of the third list that were retained, however, contained on an average 3.6 syllables apiece, while those lost contained 3.4 syllables, a slight difference in favor of the retention of the longer word. In the case of the second series, however, the difference of 0.7 was in favor of the shorter word, and in the case of the first series it was very marked, being 2.2 in favor of the shorter word.

In the case of the child the difference was 0.3 in favor of the retention of the shorter foreign word, and 0.2 of the native word. It would appear, therefore, if what I have found for my boy and myself proves true generally, that not only are shorter foreign words much more easily learned by both child and adult, but they are also more easily retained. But in the case of the adult, the shorter foreign word was not retained better than the longer, when the words, in being learned, were seen as well as heard.

## VI. TENTATIVE CONCLUSIONS, PSYCHOLOGICAL AND PEDAGOGICAL

1. In learning lists of some fifty names of animals this child of about two and a half years added 2.33 words each repetition to his store of memorized words; I added 4.35 (4 without the

visual word-sign): so that I learned the words nearly twice as fast as the child.

2. Of a list of 52 names of mammals, the child's list being half English and half French and German, and my list Japanese, the child had retained 33% and I 71%, or more than twice as many, after a six weeks' interval.

3. After a six weeks' interval this child required a little less than half as many repetitions to relearn 52 names (one-third of which had been retained) as to learn them in the first place; I required one-third as many repetitions as at first, when I had retained about the same proportion as the child. I relearned them in one-third the number of repetitions that the child required.

4. An adult will learn foreign names faster than a child and remember them better. A child would therefore appear to have no advantage over an adult but rather the contrary in any method of learning a foreign language. It is probably chiefly the adult's trained and developed capacity of attention that gives him the advantage. His wider linguistic experience is also of importance, giving him many helpful associations to aid his memory. Meumann and his assistants found a similar advantage on the part of adults when compared with older children.

5. At two and one-half years the child's linguistic habits are already sufficiently formed by the acquirement of his mother tongue to make the acquirement of a foreign language considerably more difficult than that of his own. To an English-speaking child French is more difficult of acquirement than German.

6. The longer the *foreign* word, the harder it is both to learn and to retain, for both child and adult. With the visual image, however, I found long words at least as easy to retain (though not to learn) as short ones. The length of *native* words had little perceptible effect upon facility of acquisition in the case of the child, and but a slight effect upon ease of retention.

7. Words interesting as sounds whether from agreeableness or some other striking peculiarity are easy to retain, as *chickadee* and *macaw* for the child and *nemurinezumi* and *tokaké* for myself.

8. Words hard to pronounce are hard to learn and retain, as doves, secretary-bird, stormy petrel, musk-ox, hedgehog, zebra, *renard*, *volverenne*, *raton*, *Edelhirsch*, *Flusspferdt* *Renntier* for the child, and *nokogirizame*, *hikuidori* and *saezoridori* for me.

9. With the child the auditory image of a word seemed to be very closely associated with the visual image of the animal, the latter generally calling up the former directly and promptly. With me the motor impression seemed to be more important,

the ear serving as a more or less necessary critic of the efforts of the vocal organs to form the word. The visual image of the word was generally of least importance.

10. The addition of the visual word-sign made fewer repetitions necessary for my learning of words, but was of doubtful advantage for their retention. The lack of the visual image seems to make for a deeper motor and auditory impression and a solidier attainment. The visual word-image makes for completeness rather than permanence of impression; the motor impression is more lasting though not so clearly and completely conscious. I ought to add that I have good visual as well as auditory imagination.

11. A foreign language may be learned more rapidly with the aid of the eye, but will be a more permanent possession if the attention is mainly focussed on the ear with consequent increased and *correct* use of the vocal organs. If a modern language teacher will read a great deal to his pupils in the foreign tongue and will use it himself a great deal in class, articulating with great care and accuracy, the pupil's ear will be trained to correctness of pronunciation and accent and his vocal organs will also unconsciously be exercised in the utterance of the correct speech which alone the pupil has heard and for which his ear is attuned. Thus the vocal and auditory organs will be constantly and more or less mechanically trained together, without the pupil's ever uttering a word; for we naturally repeat with unconscious movements of the vocal organs that which we hear. After some months of such unconscious learning, the pupil may be allowed to speak and read the foreign language and he will be found able from the start to do this with unwonted correctness and facility as regards pronunciation.

12. A given amount of time devoted to memorization will be more permanently effective if expended in frequent repetitions with considerable intervals, than if concentrated in fewer study periods, as discovered by Ebbinghaus with meaningless syllables and later demonstrated by Jost.

13. The actions of an animal attract a child's interest most, its form next and its color least. For this reason the child greatly prefers seeing the animal itself, especially when free, to seeing its picture, however good. Pictures of animals for children should represent them as doing things, fighting, running, chasing, climbing, swimming, drinking, etc. It is evidently not action, form and color as such, *i. e.*, as abstractions, that this child was interested in, but it is these as expressions of meaning, as interpretations of animal life. The action of the animals was fullest of meaning to this child, and consequently of interest, the form came next, and color had the least meaning.

Mere exercises in sense-training divorced from living interests are unpsychological.

14. The power of observation and redintegration, the ability intuitively to associate the various parts of which an object is composed with the object as a whole, is remarkably developed in the little child of two and a half years. There would seem to be no hard and fast line between intuition and judgment.

15. Formal, direct teaching with little children is confusing and futile.

16. The curves of acquisition of various lists of some fifty names per list all showed from three to five marked periodical rises and falls, the recovery being generally slower in the case of the child than in that of the adult.

17. Work done under conditions of fatigue not only is harmful physically, but results in mental loss and deterioration. Time spent in study by a fatigued brain is worse than wasted.

18. A child of two and a half years has little power of continuous attention and he may suffer for a considerable time without giving any perceptible sign of fatigue other than that discovered indirectly by a careful examination of his work. A little child, like a "willing horse", can easily be overworked by appeals to his affection or interests. This is probably true of children all the way up. Our school boards and exploiters of child labor are oblivious of this as of much else that vitally concerns the child.

19. The child's earliest drawings showing perception of form are determined by his interest and experience. In this child's case they were of animals, the first at the age of 2 years 4 months 18 days. If the child's drawings are of any value as a test, reproduction or the recall of free memory images must be much later and more slowly developed in him than recognition. This would indicate that his wonderfully keen perception of form and action involves but a vaguely conscious analysis, is in fact very intuitive. Children would seem to know more than we give them credit for, but are deficient in power to reproduce and to express it. My child of three does not recognize the cruder drawings of men, horses, clocks, etc., made by children of his own age, and very similar to those he makes himself.

20. The phenomena of memory throw light upon the question of degrees of consciousness, showing them to be indefinitely many. A word may be built up in the mind by gradual stages of clearness and completeness and as gradually disappear.